BIOTECHNOLOGY PAPER 1
(THEORY)

Maximum Marks: 70

Time Allowed: Three Hours

*(Candidates are allowed **additional 15 minutes** for **only** reading the paper.*
*They must **NOT** start writing during this time.)*

*Answer all questions in **Section A, Section B** and **Section C.***
The intended marks for questions or parts of questions are given in brackets [ ].

SECTION A – 14 MARKS

Question 1

(i) The thermostable enzyme used in PCR is obtained from _____. [1]

(ii) _____ is responsible for the yellow colour of golden rice. [1]

(iii) Which one of the following is the sequence on corresponding coding strand for the given mRNA sequence? [1]

5' - AUGCAUGCAUGCAUGC - 3'

(a) 3' – ATGCATGCATGCATGC – 5'

(b) 5' – TACGTACGTACGTACG – 3'

(c) 5' – ATGCATGCATGCATGC – 3'

(d) 3' – TACGTACGTACGTACG – 5'

(iv) Seema is culturing plant tissues in a suitable culture medium. She observes that the plant cells / tissues are of different types. She uses immunoglobulin coupled with dyes to isolate and sort specific type of cells of interest. [1]

Name the technique that is used by Seema to obtain the specific type of cells.

(v) Give a reason for each of the following:

(a) In Cell Culture Technology, vitamins are sterilised by using Millipore membrane filtration method. [1]

(b) *In-vitro* pollination is used to obtain inter-specific plants during the process of crop-improvement. [1]

(vi) Briefly explain the following:

(a) DNA Microarray [1]

(b) Synthetic seeds [1]

(vii) Differentiate between each of the following:

(a) Dedifferentiation and Redifferentiation [1]

(b) Start codon and Stop codon [1]

(viii) Expand each of the following:

(a) RPMI [1]

(b) HEPA [1]

(ix) **Assertion:** snRNA plays an important role in RNA splicing. [1]

Reason: snRNA is associated with ribosomes.

(a) Assertion and Reason are true, and Reason is the correct explanation for Assertion.

(b) Assertion and Reason are true, but Reason is not the correct explanation for Assertion.

(c) Assertion is true but Reason is false.

(d) Both Assertion and Reason are false.

(x) **Assertion:** In eukaryotes, cDNA library is preferred over genomic DNA library. [1]

Reason: Reverse transcription is used to form cDNA library.

(a) Assertion and Reason are true, and Reason is the correct explanation for Assertion.

(b) Assertion and Reason are true, but Reason is not the correct explanation for Assertion.

(c) Assertion is true but Reason is false.

(d) Both Assertion and Reason are false.

SECTION B – 28 MARKS

Question 2 [4]

Write short notes on each of the following:

(i) Green Fluorescent Protein selection method.

(ii) Central Dogma of Life

Question 3 [4]

(i) Briefly explain each of the following:

(a) Development of Recombinant Hepatitis B vaccine

(b) Cryopreservation

OR

(ii) Briefly explain each of the following:

(a) Non-ambiguity and Degeneracy of the genetic code.

(b) Liposome mediated gene transfer technique.

Question 4 [4]

State *any two* differences between the following:

(i) Adult Stem cells and Embryonic Stem cells.

(ii) Inducible operon and Repressible operon

Question 5 [4]

(i) Write *any four* characteristics of a good Cloning Vector.

OR

(ii) Discuss the process of Site Directed Mutagenesis.

Question 6 [4]

Give *one* reason for each of the following:

(i) Yeast cells are used to produce Recombinant Interferons.

(ii) Super Bug is used to clear oil spills.

Question 7 [4]

State *any one* use of the following instruments in cell culture technology;

(i) Autoclave

(ii) Incubator

(iii) T-flask

(iv) Inverted microscope

Question 8 [4]

A Monolayer subculture is anchorage dependent. Therefore, it is required to scale up its process by increasing the surface area of the culture medium.

Richard was working on Finite Cell lines and obtained a monolayer subculture. He used a popular scale up technique which increased the surface area of the culture medium in proportion to the number of cells and volume of the medium.

Identify and briefly explain the technique used by Richard. Mention *any one* advantage and *any one* disadvantage of this technique.

SECTION C – 28 MARKS

Question 9

(i) Elaborate on the experiment conducted by Meselson and Stahl which proved that DNA replication in prokaryotes is *semi conservative*. [4]

(ii) Briefly explain *any three* important bioinformatics database sources. [3]

OR

(i) Describe the steps in the isolation of DNA from *bacterial cells*. [4]

(ii) Discuss *any three* types of sequence alignments obtained by using BLAST. [3]

Question 10

(i) Explain the steps involved in *Southern Blotting Technique*. [4]

(ii) Describe the *3-D model* of DNA given by Watson and Crick. [3]

Question 11

(i) *Figure 1* given below shows an important process of life. Study the figure carefully and answer the questions that follow. [4]

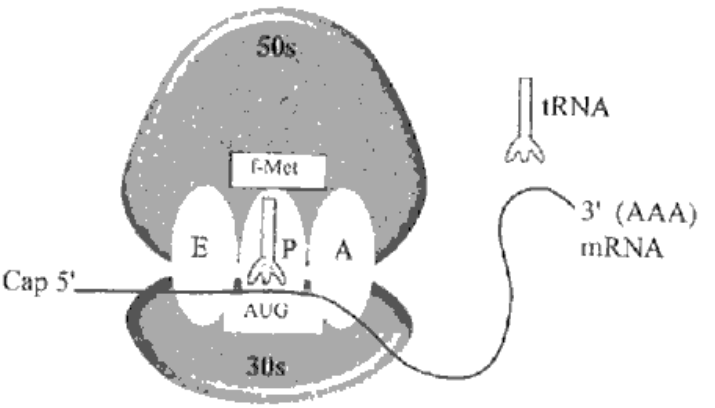

Figure 1

(a) Identify the process shown in *Figure 1*.

(b) How is this process terminated?

(c) What is the role of **'P'** site and **'A'** site in this process?

(d) State the significance of '**Cap**' of mRNA.

(ii) *Figure 2* given below represents a logo. Study the figure carefully and answer the questions that follow. [3]

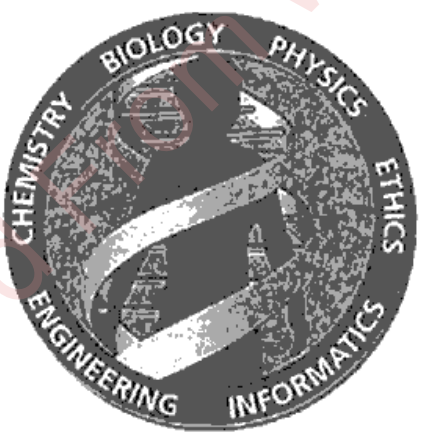

Figure 2

(a) Which project is associated with the logo shown in *Figure 2* ?

(b) Name *any two* countries involved with this project.

(c) Mention *any two* objectives of this project.

Question 12

Read the passage given below and answer the questions that follow.

A group of biotechnology researchers were studying the genome sequencing of Polar bear and Reindeer. While collecting the samples from the Arctic region, they found the carcass of an unknown species during their study.

To identify the unknown species, they isolated and amplified the DNA obtained from the carcass. They used radio-labelled ddNTPs to find out the sequence of the nitrogenous bases on DNA strand obtained from the carcass. This technique helped them to identify the unknown species.

(i) Name the technique used by the researchers to find the sequence of the nitrogenous bases on the DNA strand. [1]

(ii) Describe the technique used by the researchers to find the DNA sequence. [3]

(iii) Briefly explain how the researchers can modify the technique by using fluorescent dyes. [2]

(iv) Give *any one* difference between ddNTP and dNTP. [1]